Shapeshift Into Cyborgs:
Embedded Technology and Automated Environments

by Chelsea Palmer, 2015

Rapid Advances in Technology Appear Subtle

There is a great deal of excitement about the crucial role of information and communication technologies in the present day. However, the development of new technological systems has been a central hub of culture and ideology throughout all civilizations (Franklin, 1990; Bakardjieva, 2005; Sieh, 2012; Srinivasan, 2012). Mumford (1962) gave an excellent history of the epistemic progress of technics, from the popular adaptation of clocks and codified time, to the societal transition into industrialized production. Following this evolutionary model, some writers determined that the most apt parallel to contemporary computing technology was the widespread adoption of mechanized transport, from the railroad system to personal automobiles, as an infrastructural transformation with wide-reaching consequences (Chodos, Murphy & Hamovitch, 1997; Hughes, 2004).

Though Foucault (Rabinow, 1984) did not often address geography and societal infrastructure, in a brief interview he pointed out that as long distance communication and transport improved, larger networks of social power began to permeate people's lives. The complexity of individuals' relationships to these new tools were enhanced by nested layers of cultural influence, from local, to national, and eventually to global. As these systems of technology were widely adopted and integrated into society, they became taken for granted as part of the "landscape" of everyone's daily lives (Ling, 2012). Widespread enthusiasm is a crucial factor in such forms of societal adoption. New technologies which are introduced must meet an existing near-universal need, or significantly improve some element of life (Winston, 1998; Lehman-Wilzig & Cohen-Avigdor, 2004; Lahlou, 2008).

Mobile cellular devices have cemented the ubiquitous embrace of contemporary technology, accelerating the trend seen since the rise of the personal computer. In contrast, the introduction of Google Glass, a wearable device which ventured into the new territory of augmented visual reality, was largely mocked as excessive and invasive by the larger population, and final sank into relative obscurity (Metz, 2014). This does not necessarily indicate that "smart glasses" or other similar technologies will never be popularly embraced. Instead, it illustrates that until the crowd is enticed by a device's form and function, that device will not be successfully integrated into the social order. Once it is, though, it begins to feel like part of the natural environment, sinking comfortably into the background.

The Technological Unconscious and the Internet of Things

Beers' (2009) concept of the "technological unconscious" is an apt model for understanding the way in which our increasing immersion in information technology-laden environments becomes invisible in its familiarity. Specifically, this term refers to the constructed technological surroundings which remain largely invisible to its "inhabitants," but significantly shape and influence their choices and actions (Beers, 2009; van Dijck, 2010a). This is a natural response, as technologies are most effective when they are obscured from awareness. Lahlou (2008) outlined three operational layers of these cognitive technologies: the technical material layer (artifacts), the conceptual human layer (representations), and the social institutional layer (regulations). These layers can be viewed as a parallel to the general ecological structure of human life and culture itself.

Similarly, Bronfenbrenner's ecological model of communities locate the individual at the center of a system of nested layers. These range from the microsystem where concrete daily interactions occur, to the macrosystem of cultural norms and institutions (Bronfenbrenner, 1977; Bronfenbrenner, 1994). The crucial element of this ecological model is the interdependence between its layers, and the manner in which an individual progresses through life without analyzing these layers as distinct elements.

A similar ecological model in Community Psychology came from Kelly, who also emphasized the importance of environmental interdependence, but also focused more closely on the strategies individuals adopted to cope with their environments (Kelly, 2006). Though these theorists were both firmly focused on the social sciences, just as their model of ecology was adapted from the hard science of biology, it is similarly applicable to the hard science of technology. Interdependence and adaptation are of central importance to the strategies which human beings take in inventing and utilizing tools.

Jer Thorp (2012) pointed out that early programmers would have been shocked to imagine that one day everyone would own a computer, but almost none of them would know how to code. In the early days of computing, the only way to interact with a computer was through the command line, in the machine's "own language". However, the average end user has gotten further and further away from these inner workings, instead relying primarily on graphical interfaces and recently, environmental interactivity.

First, computers moved from text-based commands to assortments of pictures and spatial representations that represented familiar human environments (Bell, 2001; Challoner, 2008). Now, computers are creeping further into our worlds, from our screens to our physical surroundings. We're moving from clicking and typing to speaking and swiping. Our devices grow smaller, we keep them closer to hand, and as a result, we may forget what our lives were like without them (boyd, 2008; Kinsley, 2013).

The “Internet of Things” is a popular buzz-phrase, which may sound to some like a science fiction vision. All it actually refers to is the near future of automated environments, primarily in the home, filled with digitized features which fluidly blend the interactivity of our various devices. Currently, the most prominent form of this trend can be seen in centralized control of thermostats, lighting, and sound systems on owners’ cell phones and computers. The larger importance of this concept lies with the interdependence created by increasing automation, leading technological devices to “communicate” within larger webs of devices without human intervention (Barrett, 2012). This is made possible by the development of “cloud computing.”

“Cloud computing,” like the Internet of Things, is a somewhat nebulous term which can frustrate industry insiders, but it is an apt visual metaphor for the transition from local hardware-based data storage to a common remote infrastructure (Regalado, 2011). In another clear example of the technological unconscious, cloud computing has become seamlessly integrated into our use of our devices over time, especially with the rise of mobile communications (Griffith, 2015). If you take a picture on your phone, it’s probably automatically uploaded to iCloud, Dropbox, or your Google account.

The Internet of Things takes this connectivity much further than the mere transfer of existing files, though. As digitized devices gain ‘senses,’ they are able to detect and analyze input, combine that input with information received via the cloud, and make choices based on precedents and programmed preferences (Hougland, 2015). Following this trend, our worlds will continue to adjust to us, rather than us merely adapting to them.

Though the majority of computer users may not find it necessary to build a home which can send you a text message when a light bulb needs changing, the effects of increasingly embedded technological environments will have universal effects. John Barrett (2012) warned that no matter how we feel about the Internet of Things, it’s already well on its way, with companies and governments all over the globe advancing heavily in research and development. Since the Internet of Things’ range of hardware requires parallel software in order to function, it opens opportunities for independent developers to participate actively (Regalado, 2014).

This widespread collaboration will be crucial to ensure that the technology of the future is both sensible and beautiful, instead of an amalgamation of inventions just for the sake of invention (Fardost, 2015; Vanhemert, 2015). Perhaps the most urgent progress will derive from potential emergency and medical applications which would allow environments to detect health problems or life-threatening situations and trigger appropriate alerts and responses (Nipper, 2012; Barrett, 2012). This may seem like a distant future, but it's approaching rapidly-- and part of that is because our experience of time is changing, too.

Shifts in Our Experience of Time and Space

Since the invention of clocks and their accompanying universal system of time, technology has forced individuals' relative experiences of synchronicity to a regimented schedule. Time used to be something that just happened. Now it's a quantity and benchmark which we check, measure, and project. This has been further cemented in the Internet age, particularly when it comes to the satellite updates which maintain universal accuracy on people's computers and cell phones. We plot out our lives on calendars, which used to be mostly for business, but now serve as the backbone for many people's entire worlds.

However, the Internet also unhinges time from the clock in certain ways. The asynchronicity of email and similar communication methods presents a unique contrast: you can immediately access your messages at any time, but you can also defer your response for as long as you wish, for better or for worse (Franklin, 1990). There is no longer a forced window of opportunity for bidirectional communication, and it leaves us with more agency over our time. This has become even more true with the gradual "death of the phone call"-- each year, people dial one another up less and less, instead choosing text messages and emails as their primary means of communication (Thompson, 2010).

Additionally, the Internet provides such an effective, even hypnotizing, source of semi-passive entertainment, that time sometimes seems to slip through our fingers. I know I am not alone in having wasted an entire night mindlessly browsing Youtube, Reddit, or Wikipedia, only realizing my folly as the first rays of sunlight struck my window. The ability to click from hyperlink, to hyperlink, to hyperlink-- or even more captivating, to scroll down a single, endlessly-respawning page-- can plunge us into a "timeless time" (Hassan, 2003; Castells, 2004).

The timespan of our attention is now a focus of advertisers and content providers, as they collect data on the duration of time users spend visiting a site or viewing a video, rather than just the fact that they "clicked through" to it (Greenberg, 2015). The more that companies can analyze and understand what users get absorbed by online, the more they can attempt to design even more hypnotizing media in the future. This is reinforced by the fact that the time it takes for technological innovation to completely "change the game" again and again is, itself, exponentially accelerating (Kurzweil, 2014; Fardost, 2015).

Foundational Code Automates Our Available Choices

Underlying all of the changes we experience in our daily use of computer technology, the deceptively simple but complexly aggregated layer of code persists universally. While we interact with flashy images and shiny surfaces, something solid and architectural lies below the graphical interface. The underlying binary building blocks of code are binary in nature: "1" and "0" are like a primitive "yes" and "no." However complex programming may become, at the end of the day everything can be deconstructed into raw binary, just as all matter can be broken down to electrons (Winston, 1998; Challoner, 2008).

Ultimately, the binary origins of computer programming remain central to modern devices, no matter how far we advance. This universal simplicity is what makes the Internet itself possible, as data can be broken down for faster transmission, and then seamlessly reconstructed by its recipient machine (Banks, 2008; Brunton, 2013). This transmission is also based on the concrete, multi-layered material/informational infrastructure of the Internet, which is completely invisible and unknown to most users (Choucri & Clark, 2013).

The science fiction author Arthur C. Clarke famously declared that "any sufficiently advanced technology is indistinguishable from magic," and if we take this amusing quip at its face value, we could imagine code to be like a set of spells (Yáñez, 2014). Code is not just a collection of text-based instructions, it is a catalyst to execute those instructions-- whereas traditional language is largely about communication and expression, code is also about action (Mackenzie & Vurdubakis, 2011). It is constantly shifting, growing, being adjusted and improved by the intelligence of the crowd, both to encourage and adapt to the rapid growth of hardware and the online user base (Somers, 2015). It is both concrete and fluid, as what has been built up in one programming language can be tweaked and improved by the next one. There's always a movement, not toward perfection, but toward complexity and a greater range of possibilities.

Beer's (2009) description of the technological unconscious as a set of "generative rules," rather than fixed restrictions, perfectly encapsulates the unique productive power of programming code (p. 994). This brings to mind Foucault's notion of social power as a productive, rather than a repressive, force (Shiner, 1982). Power suggests possible actions and rewards obedient performance, rather than just restricting possibilities and punishing transgressions. If we see the commands set forth in code as a source of power, the establishment of precedents around "freedom of speech" in coding will be crucial in determining the balance of power in the near future (Lessig 2006; Hayles, 2009; Petersen, 2013).

Automation, and the functioning of "bots" which are designed to execute repetitive tasks on a large scale, are also crucial to the existence of the ever-expanding Internet (van Dijck, 2010; Niederer & van Dijck, 2010). However, at least for now, bots can "make mistakes" too. One small error in code can lead to an avalanche of larger errors, because while algorithms and machines may be efficient, thus far they lack the human quality of "common sense." Werbin (2011) points out that when databases are dependent upon a mixture of user-contributed information and automated tagging and categorization, the resulting reliance "on a widely dispersed and uncoordinated assemblage of people and machines to accurately input data means that each keystroke and tag contains the possibilities for errors to bleed across digital enclosures" (p. 1259). However, perhaps the continued progress of machine learning will overcome some of the bugs we see in this "beta version" of informational society.

Will We "Turn Into Cyborgs"?

Castells (2004) used the adjective "informational" in regards to contemporary capitalism to indicate a reliance not just on technologies, but on microtechnologies, the increasingly smaller and more embedded mechanisms powering our world. Franklin (1990) outlined a relevant division between the biosphere of human environments and the bitsphere of technological developments. At the time of her writing, these spheres were beginning to blend together, but there was still a distinction, one which may be gradually eroding with the accelerated integration of technology and biology. Scientists are already deeply involved in the first steps toward manipulating the biomedical properties of human cells in order to allow for accelerated regenerative healing (Stone, 2015). Engineers are already looking to design more complex smartphone processors which are modelled upon the flexible, creative capabilities of human neurons (Lewis, 2013).

These developments suggest a near future that is filled not just with functional artificial intelligence, but perhaps even with creative machines (Schmidhuber, 2012). Ray Kurzweil (2014) compared the current extension of human cognition into our environments to the general history of cerebral evolution. Kurzweil perceived the expansive capabilities of supplemental technologies as the next big cognitive shift, where devices and cloud-based data will act as a sort of neo-neocortex. The next wave of technological innovation will combine intelligent integration, continually shrinking components, and the vast expansion of cloud data storage (Milojicic, 2014). Amber Case (2010), who identified herself as a "cyborg anthropologist," pointed out that we now store many of our thoughts and feelings outside of ourselves, within our devices and data connection. Whether this cognitive externalization is a positive or negative step depends largely on the collective norms our society establishes around these practices.

When Bookchin (1971) contrasted tools with machines, he emphasized that the former serve only to enhance the existing skills of human beings, whereas the latter contain the potential to completely replace them. Technological optimists may envision a world where humanity is freed from menial labour, and thus able to pursue higher-level achievements and personal fulfillment (Rosenau & Johnson, 2002; Fuchs, 2012). Technological pessimists may instead fear an impending reality in which our humanity is eclipsed and eroded by the increasing integration of totalizing machinery into our lives (Hamilton & Heflin, 2011; Söderberg, 2013). For example, the rise of wearable technologies presents contrasting possibilities: these devices could augment our abilities and improve our daily lives, or they could split our attention and hopelessly distract us (Norman, 2013). Companies like Occipital are already strategizing how to compensate for the overlay of virtual reality in users' visual fields, designing interfaces which will alert users before they stumble into a wall while browsing the Internet on a pair of smart glasses (Metz, 2015).

Google is currently devoted to designing driverless cars, with the aim of debuting them on the public market by 2020 (Priddle, 2015). However, some are still skeptical about the wisdom of trusting vehicles to entirely automated processes, warning that there are still some situations that are better handled with common sense than machine intelligence (Knight, 2013). Foucault (1984) eloquently opined that "men have dreamed of liberating machines. But there are no machines of freedom, by definition" (p. 247). He goes on to temper this with the statement that automated technologies, structures of architecture, and other man-made advances can provide the infrastructure for what we call liberation, but that it is ultimately human actions which can carry through either productive or repressive realities in these frameworks.

We are left with these complex layers of both natural and constructed reality. Even if we ourselves are not cyborgs, our environments are embedded and thickened with technologies that are easy to overlook but impossible to escape. Baudrillard's (2007) commentary on Foucault explores "the real" as the underlying realm which all of human society attempts to move beyond, the level at which death and finitude are laid bare. Perhaps the so-called Internet of Things, and its promise to automate our access to comfort, joy, and distraction, is just the next step in humanity's attempt to progress beyond "the real." The real is inescapable, though-- even machines break down, and so far, none of our advances can keep us from death.

The enthusiastic push for constant progress in the hard sciences embodies "the notion that you can always invent something to solve the problem that the last invention created" (Vaidhyanathan, 2011, p. 76). We have not gotten to the end of this problem-solving chain, and it's not likely that we ever can. In the earnest hope to do so, we may soon render ourselves as entirely new beings, self-designed Übermensch who can control the world around us with the blink of an eye. Or, perhaps more likely, engineering will continue to alter our environments in the smallest, subtlest ways, with society pushing on, business as usual, the water heating up around us without ever quite coming to a full boil.